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ARTICLE I.

Description and Use of the Station Pointer; an Instrument for readily ascertaining the Situation of the Observer after having determined the angular Position of three known Objects. Constructed by JOSEPH HUDDART, *Esq. F. R. S. and communicated by him to the Editor.*

Instrument for giving a ship's place from obs. of two angles of azimuth only.

I HAVE long been desirous of presenting my readers with a drawing and account of the instrument which forms the subject of the present paper. Its utility in protracting the situation of a vessel upon a chart from an accurate observation by the sextant of the angular position of three known objects on shore, instead of the uncertain and rough method of bearings by compass, is great and obvious; and if any other recommendation could be desired, it would be that of its repeated application in the hands of a man of science and experience. This we have the satisfaction to possess in the public labours of Mr. Huddart, whose maritime surveys are too well known and esteemed to require the suffrage of any individual at this day. The very first occasion, when I happened to have the pleasure of conversing with him, I requested the communication of this instrument, with which he with great readiness favouredme, and from which the drawing exhibited in *Plate I.* was made.

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Deſcription. It is a protractor with three radii, which being ſet and duly placed on a chart gives the ſtation of the obſerver.

It conſiſts of a circle divided into 360° and filled with three radii, C B, C D and C A; the firſt of which is fixed at zero and the other two are moveable, and have each a nonius ſhewing ſingle minutes of a degree. The centre at C is perforated in order to admit the pointer L, which is cylindrical and well fitted to the hole, where it ſerves to give a correſpondent mark upon the chart or paper when in uſe. I is a magnifier carried by an arm, having its reflector K to throw light on the diviſions, and its cylindrical ſtem H to be inſerted in the hollow centre at C. As it muſt, while in this ſituation, prevent the introduction of the ſteel point L, the ſtem H is itſelf perforated in order to allow a ſmaller ſteel point M to be introduced for the ſame purpoſe. The radii A B and D are of braſs; but they may be prolonged to an extent that would render them heavy and inconvenient if of metal, by the addition of three rulers of wood, which are attached when required by milled head ſcrews and ſteady pins, as ſhewn by breaking the radius A, and alſo in the ſide view at G.

The arms D and B are capable of being brought very near each other, and conſequently of being ſet to a very ſmall angle; but A cannot, on account of the noniuſes, be brought within ten degrees of D. Whenever, therefore, the left hand angle happens to be ſmall, it becomes neceſſary to carry the arm A round, until by its ſituation on the other ſide of B, it comes to be employed to take the right hand angle, and conſequently leaves the left to be taken between D and B.

The pointer A is provided with a clamp, by means of which, that arm can be firſt ſecured in its place, and the pointer D is then ſet without fear of diſturbing the ſituation of the arm firſt ſet. It ſeldom happens that both angles are ſmall in maritime ſurveying; ſo that the condition that A cannot be brought very near either of the other arms, has not been found productive of inconvenience.

In *Fig.* 1. *Plate* III. let A, G, and M repreſent three objects, of which the actual diſtances from each other are known and projected in a chart. Suppoſe an obſerver at H to have meaſured the angle A H M=22°.40′, and the angle M H G = 53°.59′ it is required to protract the place H by means of the ſtation pointer.

Solution. Set the arms of the inſtrument to the reſpective angles, and apply them to the chart ſo that each point A, M, and

and G, ſhall be found upon the fiducial edge of its reſpective pointer. The center will then be found at H, which may be marked by the ſteel point. Deſcription and uſe of the ſtation pointer.

Rationale of the Proceſs. When an obſerver at H ſees M and A at the angular diſtance of 22°.40′ from each other, he muſt himſelf (by Euclid III. 20.21.) be placed ſomewhere in a circle M A H, in which the line A M is the chord of twice that angle. And ſo likewiſe when he obſerves M and G under the angle 53°. 59′ he muſt be placed in another circle M G H, of which M G is the chord of twice that angle. Conſequently H muſt be at a point common to both circles; namely where they interſect. The more direct the interſection the leſs will the reſult be affected by the errors of obſervation:—when the interſections are very oblique, the reſult will in practice become uncertain; and in the caſe where the two circles coincide throughout, the determination by two angles will be no better than by one; that is to ſay H may be any where in that circle. This laſt caſe occurs when a circle drawn through all the objects does alſo paſs through the ſtation itſelf.

In the figure already referred to H, denotes the weſt garret window of my houſe in Soho-ſquare, and the letters A, G, and M reſpectively denote the ſteeples of the pariſh churches of St. Anne Soho *, St. Giles, and St. Martin, laid down by their difference of latitude and departure from St. Paul's church, obtained from the bearings and diſtances in General Roy's Survey's in the Philoſophical Tranſactions, or the *Account of Operations carried on for accompliſhing a Trigonometrical Survey of England and Wales, &c. publiſhed in quarto by Captain Mudge and Mr. James Dalby. London*, 1799, *with 22 plates.*

The table is at pages 194, 195 of the laſt mentioned work. Whence and by obſervation with Hadley's Sextant, the data are: From St. Paul's

St. Anne's bears S. 86°. 9′. 59″ W. 7754 feet.—Southing 518.4—Weſting 7736.6 feet.

St. Martin's S. 74°. 28′. 59″ W. 6748 feet.—Southing 1805.2.—Weſting 6502.1 feet.

St. Giles S. 94°. 36′ 28″ W. 6917 feet.—Northing 55.6—Weſting 6894.7 feet.

* The ſteeple of St. Anne's church has been ſince rebuilt, and ſtands in the ſame latitude, but nine inches farther to the Eaſt than before.

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Deſcription and uſe of the ſtation pointer.

Angle obſerved between St. Giles's and St. Martin's from Soho Square 22°. 40′½.

Angle obſerved between St. Martin's and St. Anne's from ditto 53°. 59′.

Conſtruction. Draw the parallel of St. Paul's, and ſet off the points A, G, and M by the reſpective differences of latitude and of meridians to repreſent the churches of St. Anne, St. Giles and St. Martin. Join A and G, the two objects moſt remote in their bearings, and from the extremities A and G on the ſide of the line fartheſt from H, draw the lines Ah, Gh, making angles with A G reſpectively, equal to the angles obſerved on contrary ſides of the line pointing to the middle object M. Through A,h and G deſcribe a circle; and through M and h draw a right line, which prolonged will cut the circle in H. Join A H, G H, and the angles h A G, M H G, and A G h, M H A will be reſpectively equal, becauſe ſtanding on the ſame arcs h G and h A; that is to ſay, the objects will be ſeen from H under the obſerved angles, and conſequently H will be the place of the houſe.

Computation. The numbers in the figure were had by careful conſtruction on a ſcale of one inch to equal 100 feet, uſing a beam compaſs, which divides the inch into 1000 parts. But as the computation may not be unacceptable to beginners in trigonometry, I will here give the proceſs as a concluſion to the preſent paper.

1. The triangle M A G is known. We have therefore the ſide A G and two angles given in the triangle A h G, which is thus determined.

2. In the known triangle M A G by ſubducting the angle A G h from the angle A G M we gain the angle h G M which, with h G, G M, determines the triangle h G M.

3. The angle H h G is (by Euclid I. 32) equal to the ſum of the interior oppoſite angles h G M, G M h. Therefore we have the ſide h G (by paragraph 1) and the two angles H and h in the triangle H h G. Conſequently that triangle is known, and the diſtance from H, the houſe, to the object G may be had.

4. In the triangle M G H the angle at G is equal to the ſum of the known angles M G h, h G H and the other angle at H and alſo the ſide M G are known. Whence the triangle is determined, and the diſtance from H to the object M may be had.

5. In

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3. In the triangle M A H, the angle at M is equal to the difference of the known angles G M A, G M H; and the angle at H, together with the two ſides A M, H M are alſo known. Whence the third ſide H A or diſtance from the houſe to the object A may be found.

6. Laſtly the bearing of any of the three ſides of the triangle M A G may be had from the known difference of latitude and meridianal diſtance of its extremities: And this bearing may with eaſe be then applied to ſhew the bearings of the lines H A, H M, H G.

W. N.

II.

Experimental Eſſays on the Conſtitution of mixed Gaſes; on the Force of Steam or Vapour from Water and other Liquids in different Temperatures, both in a Torricellian Vacuum and in Air; on Evaporation; and on the Expanſion of Gaſes by Heat. By JOHN DALTON.

(*Concluded from Page* 273, Vol. VI.)

ESSAY III.

ON EVAPORATION.

WHEN a liquid is expoſed to the air it is gradually diffi- Evaporation defined.
pated in it. The proceſs by which this effect is produced we call evaporation.

Many philoſophers concur in the theory of chemical ſolution: Theory which aſcribes evaporation to chemical ſolution in air—
atmoſpheric air, it is ſaid, has an affinity for water; it is a menſtruum in which water is ſoluble to a certain degree. It is allowed notwithſtanding by all, that each liquid is convertible into an elaſtic vapour in vacuo, which can ſubſiſt independently in any temperature; but as the utmoſt forces of theſe vapours are inferior to the preſſure of the atmoſphere in ordinary temperatures, they are ſuppoſed to be incapable of exiſting in it in the ſame way as they do in a torricellian vacuum: hence the notion of affinity is induced. According to this theory of evaporation, atmoſpheric air (and every other ſpecies of air for aught that appears) diſſolves water, alkohol, ether, acids, and even metals. Water below 212° is chemically combined with the gaſes; above 212° it aſſumes a new form, and

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Station Pointer by Joseph Huddart, Esq.r F.R.S.

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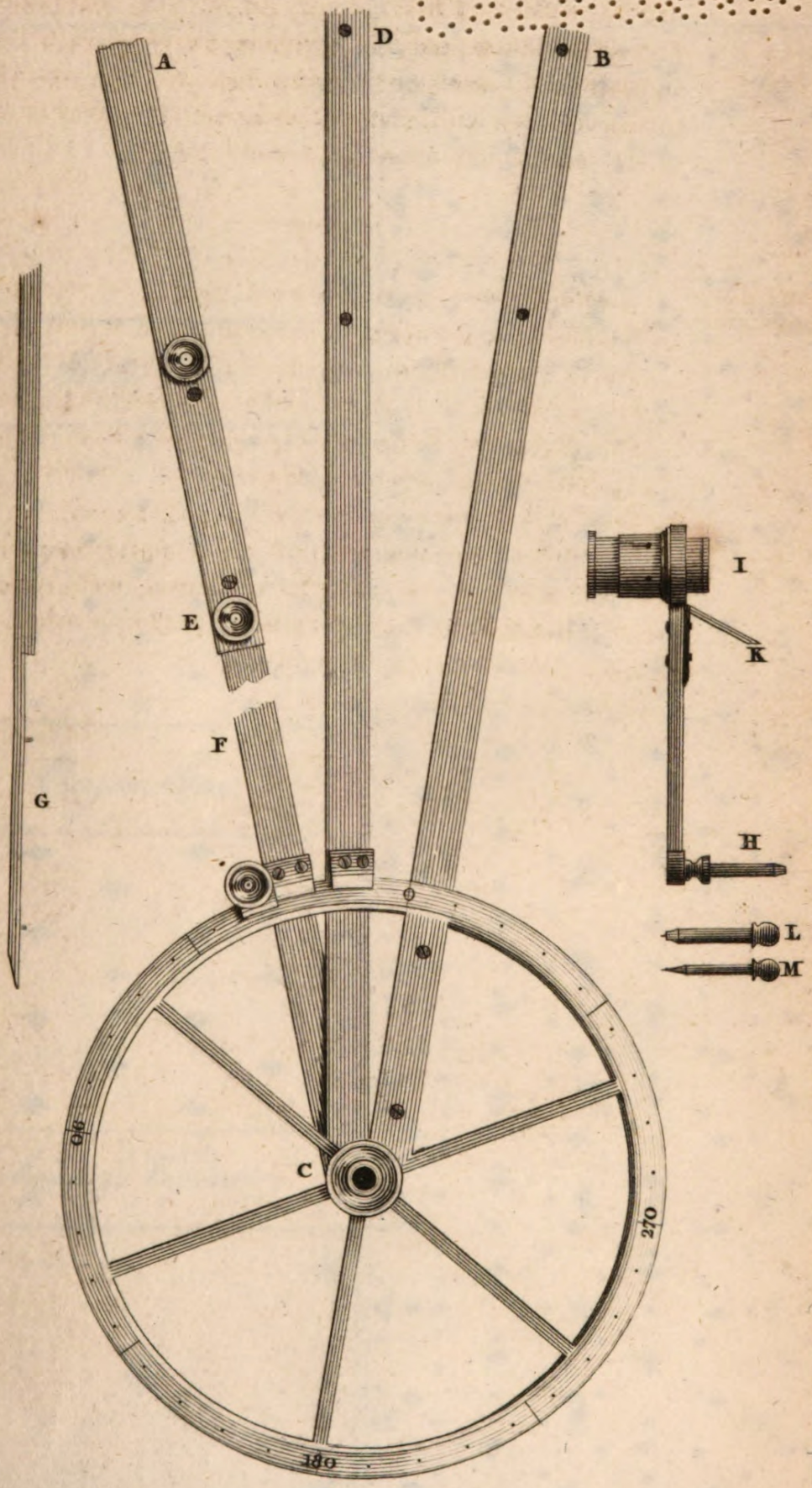

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Determination of Positions by observation of three known objects.

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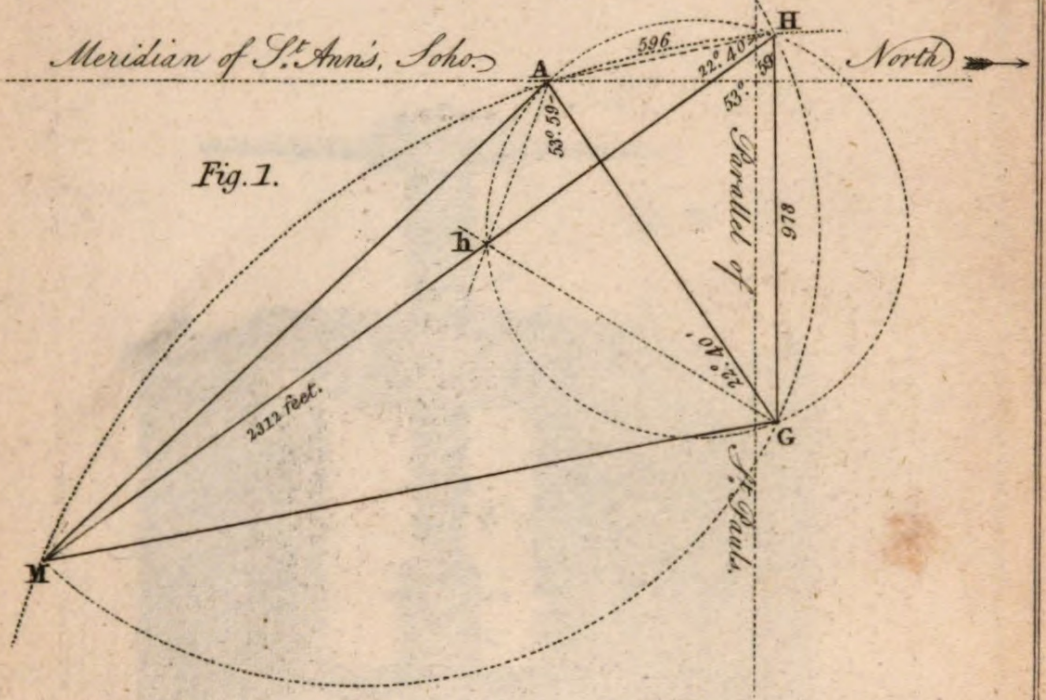
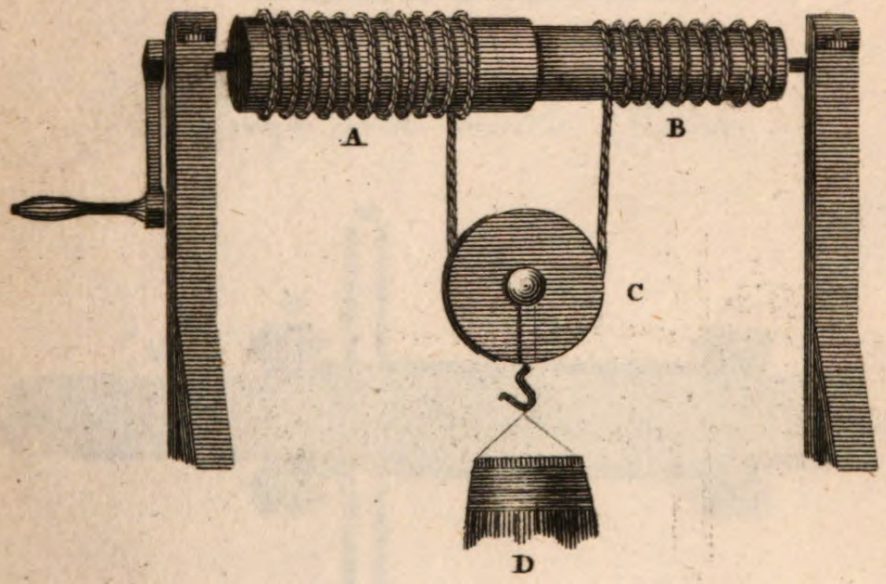


Fig. 1.

Winch & Barrell, (double)

Fig. 2.



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